

**Claims:**

1. A method for preparing a porous SOG film comprising the steps of preparing a solution containing an organic silane, water and an alcohol, subjecting said organic silane to acid hydrolysis or alkali hydrolysis and then heat-treating a resulting reaction system in the presence of a surfactant to thus form a porous  $\text{SiO}_2$  film.

2. The method for preparing a porous SOG film as set forth in claim 1 wherein said method further comprises the step of repeating, at least one time, said first step for preparing said porous  $\text{SiO}_2$  film to thus form, in order, an additional porous  $\text{SiO}_2$  film on said porous film prepared in said first step.

3. The method for preparing a porous SOG film as set forth in claim 2 wherein said method further comprises a second step in which either of a  $\text{SiO}_2$  film, a  $\text{SiN}_x$  film and a  $\text{SiO}_x\text{N}_y$  film is formed on said porous  $\text{SiO}_2$  film prepared in said first step by a CVD or sputtering method to thus cap the surface of said porous film and a step of repeating said first and second steps at least one time to form a multilayered film.

4. The method for preparing a porous SOG film as set forth in claim 1 wherein after forming said porous  $\text{SiO}_2$  film, either of a  $\text{SiO}_2$  film, a  $\text{SiN}_x$  film and a  $\text{SiO}_x\text{N}_y$  film is formed on the surface of said porous  $\text{SiO}_2$  film by a CVD or sputtering method to thus cap the surface of said porous film and to thus form a porous  $\text{SiO}_2$  film.

5. The method for preparing a porous SOG film as set forth in claim 1 wherein after forming said porous  $\text{SiO}_2$  film, unreacted OH groups remaining in said  $\text{SiO}_2$  porous film are removed by subjecting said porous  $\text{SiO}_2$  film to either of an oxygen plasma-treatment, an electron beam-irradiation and a UV light-irradiation treatment to thus form a porous  $\text{SiO}_2$  film.

6. The method for preparing a porous SOG film as set forth in claim 1 wherein said heat-treatment comprises a first heat-treating step carried out at

a temperature sufficient for mainly evaporating said water and alcohol present in a reaction system and a second heat-treating step carried out at a temperature sufficient for covering at least inner walls of holes present in a resulting porous  $\text{SiO}_2$  film with hydrophobic moieties of surfactant, said temperature used in said second step being higher than that used in said first step.

7. The method for preparing a porous SOG film as set forth in claim 6 wherein said second heat-treating step is carried out at temperatures ranging from 350 to 450 °C.

8. A method for preparing a porous SOG film comprising the steps of mixing an organic silane, water, an alcohol and an acid or an alkali, adding a surfactant to a mixture thereof to prepare an organic silane solution, spin-coating said organic silane solution on a semiconductor substrate to obtain a coated layer and then heat-treating said coated layer to evaporate said water, alcohol and surfactant and to thus form a porous  $\text{SiO}_2$  film.

9. The method for preparing a porous SOG film as set forth in claim 8 wherein said method further comprises the steps of forming either of a  $\text{SiO}_2$  film, a  $\text{SiN}_x$  film and a  $\text{SiO}_x\text{N}_y$  film on the surface of said porous  $\text{SiO}_2$  film obtained after said heat-treatment by a CVD or sputtering method to thus cap the surface of said porous film and then repeating said heat-treating and capping steps at least one time to form a multilayered film.

10. The method for preparing a porous SOG film as set forth in claim 8 wherein after forming said porous  $\text{SiO}_2$  film, either of a  $\text{SiO}_2$  film, a  $\text{SiN}_x$  film or a  $\text{SiO}_x\text{N}_y$  film is formed on the surface of said porous  $\text{SiO}_2$  film by a CVD or sputtering method to thus cap the surface of said porous film and to thus form a porous  $\text{SiO}_2$  film.

11. The method for preparing a porous SOG film as set forth in claim 8 wherein after forming said porous  $\text{SiO}_2$  film, unreacted OH groups remaining in said porous film are removed by subjecting said porous film to either of an

